CLAIMS

WE CLAIM:

1. An ionization detector comprising:

a front and rear plate positioned on a front and rear side of a volume of ionizable fluid to receive a voltage there across to thereby collect charges resulting from radiation ionizing the gas;

wherein the rear plate is formed of a printed circuit board providing a collector on its front surface and multiple layers including a middle layer providing at least one signal trace and a first and second ground layer flanking the signal trace layer; and

wherein the signal trace connects to the collector.

2. The ionization detector of claim 1 wherein the printed circuit board further provides a guard ring surrounding the collector on the front surface and wherein at least one of the ground layers connects to the guard ring.

3. The ionization detector of claim 1 wherein the printed circuit board further provides a high voltage feed outside of the guard ring and communicating the front plate.

4. The ionization detector of claim 1 wherein the front plate is supported by the printed circuit board at the high voltage feed.

5. The ionization detector of claim 1 wherein the collector and the guard ring are a disk and concentric ring, respectively, and the front plate is a cup inverted over the guard ring and collector.

6. The ionization detector of claim 1 wherein the printed circuit board is copper clad epoxy-impregnated fiberglass.

7. The ionization detector of claim 1 further including a port to equalize pressure within the ionization chamber.

8. The ionization detector of claim 1 wherein the signal trace connects to the collector by a conductive via.

9. The ionization detector of claim 1 wherein the printed circuit board further includes signal-processing circuitry receiving the signal trace.

10. A test instrument for therapeutic radiation comprising:

a set of spaced radiation flux-detectors providing flux signals;

at least one radiation energy-detector providing an energy signal;

a storage system for storing benchmark flux values associated with a set of energy ranges; and

processing circuitry comparing at least one of the flux signals to the benchmark flux values of an energy range corresponding to the energy signal to provide an indication of any improper operation of a measured radiation source.

11. The test instrument of claim 10 wherein the energy ranges are centered at energies selected from the group consisting of: 6, 9, 12, 16, and 22 MeV and 6, 18, and 23 MV.

12. The test instrument of claim 10 further including a display displaying one of the energy ranges.

13. The test instrument of claim 10 wherein the processing circuitry provides an alarm signaling an energy deviating more than a predetermined amount from a stored energy range.

14. The test instrument of claim 10 wherein the flux signals and benchmark flux values provide a measure of radiation flatness and wherein the processing circuitry provides an alarm when the radiation flatness indicated by the flux signals is more than a predetermined amount different from the radiation flatness indicated by the benchmark flux values for the corresponding energy range.

15. The test instrument of claim 10 wherein the flux signals and benchmark flux values provide a measure of radiation symmetry and wherein the processing

circuitry provides an alarm when the radiation symmetry indicated by the flux signals is more than a predetermined amount different from the radiation symmetry indicated by the benchmark flux values for the corresponding energy range.

16. The test instrument of claim 10 wherein the processing circuitry provides an alarm when the flux signals are more than a predetermined amount different from benchmark flux values for the corresponding energy range.

17. The test instrument of claim 10 wherein the radiation energy-detector is a set of detectors having different filtration to provide radiation signals and wherein the energy signal is derived from an algebraic combination of the radiation signals from the set of detectors.

18. The test instrument of claim 10 wherein the radiation energy-detector is a set of detector elements providing radiation signals at least one of which detector element has a scatter element positioned behind it with respect to the measured radiation so that the detector element is sensitive to backscatter and wherein the energy signal is derived from an algebraic combination of the radiation signals.

19. A combination photon and electron therapeutic radiation test apparatus comprising:

a housing providing opposed first and second faces;

a set of detectors held between the first and second faces;

a first calibrating material for electrons positioned to intercept electrons passing through the first face to the detectors; and

a second calibrating material for photons positioned to intercept photons passing through the second face to the detectors;

whereby electrons may be measured with the housing in a first orientation by exposing the detectors through the first face and photons may be measured by flipping the housing to a second orientation and exposing the detectors through the second face.

20. The test apparatus of claim 19 wherein the first and second calibrating materials are build-up materials to optimize the sensitivity of the flux measurements for electrons and photons, respectively.

21. The test instrument of claim 19 wherein the first and second calibration materials are different thicknesses of a water equivalent material.

22. The test instrument of claim 19 wherein the apparatus includes an input for providing an indication of whether electrons or photons are being measured.

23. The test instrument of claim 22 wherein the input is a manually operated switch.

24. The test instrument of claim 19 further including a display indicating radiation type.

25. The test instrument of claim 19 further including a display indicating a quantitative radiation measurement.

26. The test instrument of claim 25 display is on a third face of the housing visible when either the first or second faces is lying against a surface.

27. The test instrument of claim 26 wherein the display flips its orientation according to whether electrons or photons are being measured so as to be upright to a operator when the housing is resting with the first or second face on a horizontal support.

28. A wire-free beam checker for therapeutic radiation systems comprising:

a housing containing:

a set of radiation detectors for measuring radiation flux at predetermined locations;

a solid-state memory for receiving and storing the radiation flux measurements;

a battery powering the radiation detectors and solid state memory; and

a port for periodically downloading the stored radiation flux measurements to a remote instrument through the port.

29. The wire free beam checker of claim 28 further including a cradle into which the housing may dock, the cradle having a cradle port communicating with the port.

30. The wire free beam checker of claim 29 wherein the housing includes a connector for providing a charging current to the battery and wherein the cradle further includes a second connector for connecting to the connector on the housing for charging the battery.

31. The wire free beam checker of claim 29 wherein the cradle further includes a third port for communicating the received real-time flux data and control commands to and from a remote computer.

32. The wire free beam checker of claim 28 including a shield held within the housing and shielding the solid-state memory from radiation.

33. The wire free beam checker of claim 28 wherein the housing includes a light field guide delineating a region of the housing containing the detectors that should be exposed to radiation and wherein the processing circuitry and memory are within the housing outside of the region.

34. The wire free beam checker of claim 28 including an internal clock communicating a time signal to the memory whereby the memory may store a time of acquisition of the radiation flux measurements.

35 The wire free beam checker of claim 28 wherein the housing further includes an energy-detector communicating an energy signal to the memory whereby the memory may store an energy range of the radiation flux measurements.

36 The wire free beam checker of claim 28 further including processing circuitry contained within the housing and communicating with at least some of the radiation detectors to detect the start of a new radiation measurement from the signals produced by radiation detectors to automatically store the radiation measurements for the new radiation measurement in a new file in the solid state memory.